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EXAMINER

BARRECA, NICOLE M

ART UNIT PAPER NUMBER

1756

DATE MAILED: 08/16/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/745,350

Applicant(s)

SABNIS ET AL.

Examiner

Nicole M Barreca

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 March 2004 and 06 July 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-14, 16-26, 28-30 and 83 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 1-14 and 16-18 is/are allowed.
- 6) ☒ Claim(s) 19-26, 28-30 and 83 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

1. Claims 1-14, 16-26, 28-30 and 83 are pending in this application. Please note that claims 31-82 have been CANCELED in the amendment submitted on 9/24/2002.

Claim Objections

2. Claims 20, 23, 25, 26, 28 and 29 are objected to because of the following informalities: Claims 20, 25, 26, 28 and 29 recite "antireflective compound layer" and claim 23 recites "antireflective compound", while claim 19 as amended recites "antireflective layer" only. Appropriate correction is required.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 21-22 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 21 recites, "at least one of said cyclic moieties is heterocyclic or aromatic". However claim 19 as amended only claims recurring monomers having a formula of a single cyclic moiety. It is therefore unclear if the polymer in the antireflective layer is limited to a single repeating cyclic monomer or if may be a co-polymer including two or more monomers, one of which is cyclic.

Response to Amendment

5. The 35 USC 103 rejection of claims 1-14 and 16-18 over JP 8-064492 is withdrawn in response to the applicant's amendment limiting each R to an alkyl group.

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The 35 USC 102 rejection of claims 19, 21-23, 25, 28 and 29 over Haaland is withdrawn in response to the applicant's amendment limiting the antireflective layer to have comprise a polymer having a recurring cyclic monomer.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 19-26 and 28-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pawlowski (6277750).

Pawlowski discloses a composition for a bottom antireflective layer comprising a polymer dye represented by the general formula 1. The polymer includes a cyclic moiety in the polymer backbone connected by linkage groups. R (applicant's X) may be hydrogen, or substituted or non-substituted cycloalkyl or aryl groups. The bottom antireflective layer is coated on a substrate such as a silicon wafer to a thickness of 60 nm (600 angstroms), followed by deposition of an overlying photoresist layer. The polymer dye absorbs radiation in the range of 150-450 nm. The k value at 248 nm was found to be 0.4. See col.6, 20-col.7, 12, col.12, 34-44, col.13, 22-24. While the reference does not explicitly disclose that at least 90% of light in this wavelength region is absorbed, one of ordinary skill in the art would have to have expected that a majority of light would have to be absorbed in order for the polymer dye to be useful as an antireflective film in a photolithographic patterning process. The reference is silent on

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some specific process conditions and does not disclose that the strain energy is at least about 10 kcal/mol. However it would be within the ordinary skill of one in the art to determine this optimal process conditions in the method JP 8-064492 by routine experimentation because the discovery of an optimum value of a result effective variable is ordinary within the skill of the art, as taught by *In re Boesch* (617 F.2d 272, 205 USPQ 215 (CCPA 1980)). The reference is silent on if the thickness of the layer will change by less than about 10% in solvents utilized in the photoresist layer or on if the percent conformality of the substrate surface is at least about 85%. However it would have been obvious to one of ordinary skill in the art to form an antireflective layer with these properties because these are desirable properties for a coating composition. While the reference is silent on if the substrate has features defining holes and that the antireflective layer is on these holes, one of ordinary skill in the art would recognize that semiconductor substrates routinely contain hole-defining structures prior to photolithographic patterning.

8. Claims 19-26 and 28-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Knors (5654376).

Knors discloses a composition for a antireflective layer comprising a polymer dye. The polymer contains repeating cyclic units represented in claim 6 or claim 7. R1-6 may be hydrogen, alkyl, or phenyl. Examples teach forming the antireflective layer on a silicon wafer to a thickness of 50-200 nm (500-2000 angstroms), followed by deposition of an overlying photoresist layer. The polymer dye absorbs radiation in the near or deep UV range (193-436 nm). See col.5, 29-35, col.9-col.12. While the

reference does not explicitly disclose that at least 90% of light in this wavelength region is absorbed, one of ordinary skill in the art would have to have expected that a majority of light would have to be absorbed in order for the polymer dye to be useful as an antireflective film in a photolithographic patterning process. The reference is silent on some specific process conditions and does not disclose that the strain energy is at least about 10 kcal/mol or that k is at least 0.1. However it would be within the ordinary skill of one in the art to determine these optimal process conditions in the method JP 8-064492 by routine experimentation because the discovery of an optimum value of a result effective variable is ordinary within the skill of the art, as taught by *In re Boesch* (617 F.2d 272, 205 USPQ 215 (CCPA 1980)). The reference is silent on if the thickness of the layer will change by less than about 10% in solvents utilized in the photoresist layer or on if the percent conformality of the substrate surface is at least about 85%. However it would have been obvious to one of ordinary skill in the art to form an antireflective layer with these properties because these are desirable properties for a coating composition. While the reference is silent on if the substrate has features defining holes and that the antireflective layer is on these holes, one of ordinary skill in the art would recognize that semiconductor substrates routinely contain hole-defining structures prior to photolithographic patterning.

9. Claims 19-24, 26 and 28-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fahey (5607824).

Fahey discloses a composition for an antireflective layer comprising a co-polymer having the general formula as illustrated in col.3-4. The co-polymer has repeating cyclic

moieties connected by linkage groups and has a strong absorption at 248 nm. The antireflective layer is coated on a wafer, followed by deposition of a DUV photoresist. While the reference does not explicitly disclose that at least 90% of light in this wavelength region is absorbed, one of ordinary skill in the art would have to have expected that a majority of light would have to be absorbed in order for the polymer dye to be useful as an antireflective film in a photolithographic patterning process. The reference is silent on some specific process conditions and does not disclose that the strain energy is at least about 10 kcal/mol or that k is at least 0.1. However it would be within the ordinary skill of one in the art to determine these optimal process conditions in the method JP 8-064492 by routine experimentation because the discovery of an optimum value of a result effective variable is ordinary within the skill of the art, as taught by *In re Boesch* (617 F.2d 272, 205 USPQ 215 (CCPA 1980)). The reference is silent on if the thickness of the layer will change by less than about 10% in solvents utilized in the photoresist layer or on if the percent conformality of the substrate surface is at least about 85%. However it would have been obvious to one of ordinary skill in the art to form an antireflective layer with these properties because these are desirable properties for a coating composition. While the reference is silent on if the substrate has features defining holes and that the antireflective layer is on these holes, one of ordinary skill in the art would recognize that semiconductor substrates routinely contain hole-defining structures prior to photolithographic patterning.

10. Claim 83 is rejected under 35 U.S.C. 103(a) as being unpatentable over JP 8-064492 (English translation from JPO website and USPTO).

11. JP 8-064492 discloses a pattern forming method using an antireflection film. The antireflective film 3 is deposited using a vapor deposition film of nonmetallic phthalocyanine. The antireflective film absorbs light in a wavelength range of 140-450 nm. A photoresist pattern 4a is formed on the film by exposure and development, the surface of film 3a is removed by O₂ plasma RIE and base material 2 is etched. The photoresist and antireflective layers are removed by a peeling liquid or ashing (abstract). The antireflective film consists of an organic compound and has an optical absorption in the 150-450 nm range. The organic compounds comprise cyclic moieties connected with linkage groups. See formula 1 and 2 [0030]-[0033]. R1-R4 may be hydrogen atoms, -OCH₃ or C(CH₃) [0032]. See also the claims where it teaches that the organic compound may be alkoxy-substituted, alkyl-substituted or unsubstituted. The antireflective films are formed by vapor growth [0015]. JP 8-064492 teaches that the organic compound of the antireflective layer has an optical absorption in the 150-450 nm wavelength region. While the reference does not explicitly disclose that at least 90% of light in this wavelength region is absorbed, one of ordinary skill in the art would have to have expected that a majority of light would have to be absorbed in order for the organic compound to be useful as an antireflective film in a photolithographic patterning process.

Allowable Subject Matter

12. Claims 1-14, 16-18 are allowed.
13. The following is a statement of reasons for the indication of allowable subject matter: the prior art fails to teach or suggest a method for use in manufacturing

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integrated circuits wherein an antireflective compound comprising the claimed formula, including the two cyclic moieties joined by an alkyl linkage group and X as claimed, is subjected to CVD so as to deposit an ARC layer on a substrate that absorbs at least 90% of light at a wavelength from about 150-500 nm.

Response to Arguments

14. Applicant's arguments with respect to claim 83 have been fully considered but they are not persuasive. As discussed in the preceding rejection, in addition to teaching that X may be a halogen, the reference also teaches that X may be hydrogen, or an alkyl and therefore meets the claimed limitations.

Conclusion

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nicole M Barreca whose telephone number is 571-272-1379. The examiner can normally be reached on Monday-Thursday (9AM-7PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on 571-272-1385. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Nicole M Barreca
Examiner
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8/10/04